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GUIDELINES ON WARNING DEVICES FOR CONTROLLED AREAS

M. Awschalom, H. Howe & F. Schamber

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I. Radiation Protection Areas

1. Definitions

1.1 Uncontrolled Area - Any area, access to which is not controlled for purposes of radiation safety.

1.2 Controlled Area - Any area, access to which is controlled for purposes of radiation safety. "Radiation Safety" is used in the most general sense. Thusly, an area may be designated as a controlled area in order to facilitate a consistent program of radiation safety, even though radiation is not present or anticipated. An example is the cross-gallery.

2. Real Time Classification of Radiation Areas

2.1 The classification of radiation area type may change periodically, depending on accelerator operating conditions and other factors.

2.2 In general, the controlled/uncontrolled designation will be "permanent". The classification of controlled areas shall reflect current radiation conditions.

3. Area Classification in Terms of Maximum Possible Radiation Doses

3.1 Dose rates refer to normal operating conditions.

3.2 Uncontrolled - $D \leq 2.0$ mrem in any one 8 hr period.

3.3 Controlled - $D > 2.0$ mrem in any one 8 hr period.

3.4 Classification of controlled areas is made by the maximum possible dose equivalent a person may absorb in any one given period.

3.4.1	Personnel Dosimeter Area	$D > 2.0$ mrem in any 8 hr period
3.4.2	Radiation Area	$D \geq 2.5$ mrem in any 1 hr
	but	$D < 20.$ mrem in any 1 hr
3.4.3	High Radiation Area	$D \geq 20.$ mrem in any 1 hr
	but	$D \leq 100.$ mrem in any 1 hr
3.4.4	Very High Radiation Area	$D > 100.$ mrem in any 1 hr

3.4.5 Exclusion Area is an area from which all personnel are excluded.

3.4.6 D = Dose equivalent that may be absorbed by a major portion of the body (whole body, head

and trunk), active blood forming organs, gonads or lenses of the eyes.

II. Warning Devices

1. Definition. The term "warning" shall be uniformly applied to all techniques which convey information about radiation hazards as well as about radiation protection requirements at the point of concern.

2. Fundamental Principle. Warnings shall always be true in order to ensure maximum credibility and adherence.

3. Display of Warnings

3.1 Warnings shall always be displayed when and where appropriate.

3.2 Warnings will not be displayed when not needed. Note: In situations in which error is unavoidable, it is clearly better to display unnecessary warnings. However, efforts shall be made to remedy such situations as soon as possible.

4. Warnings shall be self-explanatory, i.e., their meaning shall be clear, direct and unmistakable.

5. Each warning device shall warn about only one type of hazard.

6. Standardization. Standardized radiation warning devices (symbols, conventions and wordings) shall be used throughout the Laboratory. These standards will be as compatible as possible with radiation practices used elsewhere. Visual warnings of radiation hazards shall always use the standard color convention of magenta on yellow.

7. Classification of Warning Devices

7.1 General Warning Devices provide information and detail general procedures. These devices are typically permanent signs. They are so worded that they are never inappropriate.

7.2 Caution Warning Devices state specific hazard and/or radiation status. These warnings may reflect potentially hazardous situations as well as immediate hazards. They should generally reflect current conditions but they may be anticipatory. Such devices shall be visible and readable by anyone entering or working within the affected area.

7.3 Danger Warning Devices demand immediate attention of anyone entering or working within the affected area. Intermittent or pulsing devices are normally used. Such devices should be carefully designed to correspond to actual hazard conditions (e.g., triggered by beam current or radiation monitor).

7.4 Emergency Warning Devices demand immediate action (such as evacuation). Very high intensity warning devices should be used. Response to this warning should be automatic. Ideally, an emergency warning device should never be seen or heard except under emergency situations.

7.5 The evacuation klaxon may be activated by hazards other than radiation.

7.6 The following devices are considered to be appropriate for use as the indicated levels of warning. Where framed, they are minimum required devices.

Warning Device:	General	Caution	Danger	Emergency
Printed permanent signs	[Yes]	Yes	Yes	Yes
or				
Printed temporary signs	[Yes]	[Yes]	No	No
or				
Lighted static sign	No	[Yes]	[Yes & Yes]	No
Audible Alarm *	No	No		No
or				
Lighted flashing sign **	No	No	[Yes]	[Yes & Yes]
Evacuation Klaxon ***	No	No	No	
Public Address	No	No	Yes	Yes
Flashing or pulsing light (magenta)	No	No	Yes	Yes

* Easily distinguishable from evacuation klaxon.

** Or lit sign plus adjacent flashing light.

*** Such as Federal Sign And Signal Corporation, Selectone (t.m.) Model 300, with TM-4 "whoop" tone module. This particular tone has been adopted as the evacuation sound for all NAL facilities regardless of the hazard involved.

7.7 Light dimming is not considered an acceptable warning device.

III. Specific Minimum Warning Requirements

1. Uncontrolled Areas. No warnings of any type.

2. Controlled Areas.

2.1 Personnel Dosimeter Area.

General Warning Device required. Permanent

(rarely semi-permanent) signs shall be affixed to all entrances and access points to controlled areas reading "Personnel Monitoring Devices Are Required Beyond This Entrance". Information telling where such devices can be obtained shall be included.

2.2 Also one of the following when applicable:

2.2.1 Radiation Area.

Caution Warning. "Caution - Radiation Area" sign plus dose rate and occupancy time. Permanent Caution Warnings may be appropriate to detail conditions or hazard (e.g., "Radioactive Materials Area").

2.2.2 High Radiation Area.

Danger Warning. "Danger - High Radiation Area" sign with appropriate attention getting device. This shall only be displayed when high radiation levels are actually present.

2.2.3 Very High Radiation Area.

"Danger - Very High Radiation Area" sign plus appropriate attention getting device. If access is limited, then the name of the person(s) allowed to permit access shall be posted near the entrance to that area.

2.2.4 Exclusion Area.

"Danger - Very High Radiation - KEEP OUT" sign at entrance. Danger warning devices to flush out all personnel prior to exclusion condition. Emergency device(s) are used to alarm personnel who might have been left inside after search and secure. The name of the person(s) allowed to permit access shall be posted near the entrance to the area.

IV. General Radiation Safety Requirements in Controlled Areas

Area	Warning Level	Personnel Barriers	Access Interlock	Scram Devices	Personnel Monitoring Device
Personnel Dosimetry	General	No	No	No	Badge
Radiation	Caution	None or tapes on floor and/or walls	No	No	Badge
High Radiation	Danger	Ropes or temporary devices	Seldom *	No	Badge plus **
Very High Radiation	Danger	Semi-permanent fences or walls	Possibly *	Possibly*	Badge plus **
Exclusion	Danger + emergency	Permanent fences or walls	Yes	Yes	Badge plus **

* The Radiation Safety Officer and the person operationally in charge of the area will determine the need for such device/function.

** Various additional personnel monitoring devices are available such as rate alarms, dose integrators with alarms, quick reading devices (such as pocket ion chambers), finger dosimeters, etc. The Radiation Safety Officer and the person operationally in charge of the area will agree on the special devices to be worn by the personnel working in that area.

V. Authorization to Work in Controlled Areas

1. All work in Controlled Areas shall be requested and authorized by the Head of the Operations Section.

2. Work practices shall be agreed upon by the Radiation Safety Officer and the Head of the Operations Section.

VI. Supervision of Workers in Controlled Areas

1. Different levels of workers' supervision will be used depending on the radiation level of the area and on the radiation workers' experience with radiation safety practices.

2. A set of general guidelines for the level of supervision that may be needed are given below.

Controlled Area	Honor Badge Holder	Non-Honor Badge Holder
Personnel Dosimeter	None	None
Radiation	None	Honor Badge Holder
High Radiation	None	Honor Badge Holder + *
Very High Radiation	**	Honor Badge Holder + **
Exclusion	**	**

* Some prior instruction of the worker on radiation safety shall be given by the Radiation Safety Officer or some especially designated Honor Badge holder.

** The Radiation Safety Officer shall be involved in the instruction of the person working in that area on radiation safety precautions to be taken for the specific job at hand.

Appendix 1

Permanent Signs

Magenta lettering on yellow background.

One or two radiation symbols.

The following legends will be most useful,

CAUTION - RADIATION AREA

DANGER - HIGH RADIATION AREA

DANGER - VERY HIGH RADIATION AREA

CAUTION - RADIOACTIVE MATERIALS

PERSONNEL MONITORING DEVICES REQUIRED BEYOND THIS ENTRANCE

Illuminated Signs

These signs will normally be custom made.

The general rules are: magenta lettering on a yellow background. They must have one or two radiation symbols. A neutral-density cover plate should be provided to obscure the sign when not illuminated.

Standard Radiation Sign